

Section Record: 100% Issue for Construction, 09/28/11

**SECTION 07 52 16**

**STYRENE-BUTADIENE-STYRENE MODIFIED BITUMINOUS MEMBRANE ROOFING, HOT-APPLIED**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. This section specifies modified bituminous sheet roofing and base flashing installed using hot-applied asphalt on new construction with granular coating or coated smooth surface.
- B. System shall be "4-ply" SBS modified bitumen system consisting of mechanically fastened vented base sheet over lightweight insulating concrete; two(minimum) piles hot-mopped SBS sheets; and hot-mopped granular surfaced cap sheet.

**1.2 RELATED WORK:**

- A. Wood cants, blocking and wood edge strips: Section 06 10 00, ROUGH CARPENTRY.
- B. Roof Insulation under Membrane: Section 07 22 00, ROOF AND DECK INSULATION.
- C. Sheet metal components and wind uplift requirements for roof-edge design: Section 07 60 00, FLASHING AND SHEET METAL.
- D. Miscellaneous items: Section 07 72 00, ROOF ACCESSORIES.

**1.3 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.
- B. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):  
ASCE/SEI-7-10.....Minimum Design Loads for Buildings and Other Structures
- C. Asphalt Roofing Manufacturers Association/National Roofing Contractors Association (ARMA/NRCA): Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing

D. ASTM International (ASTM):

- D146-04.....Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing
- D312-00(R2006).....Standard Specification for Asphalt Used in Roofing
- D2523-00(R2006).....Standard Practice for Testing Load-Strain Properties of Roofing Membranes
- D3960-05.....Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
- D4073-06.....Standard Test Method for Tensile-Tear Strength of Bituminous Roofing Membranes
- D4586-07.....Asphalt Roof Cement, Asbestos Free
- D4897-01.....Asphalt Coated Glass Fiber Venting Base Sheet Used in Roofing
- D5147-07.....Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material
- D6163-00(R2008).....Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements
- E108-10.....Standard Test Methods for Fire Tests of Roof Coverings

E. FM Approvals: RoofNav Approved Roofing Assemblies and Products.

- 4450-89.....Approved Standard for Class 1 Insulated Steel Deck Roofs
- 4470-10.....Approved Standard for Class 1 Roof Coverings
- 1-28-09.....Loss Prevention Data Sheet: Design Wind Loads.
- 1-29-09.....Loss Prevention Data Sheet: Above-Deck Roof Components
- 1-49-09.....Loss Prevention Data Sheet: Perimeter Flashing

F. National Roofing Contractors Association: Roofing and Waterproofing Manual

**1.4 PERFORMANCE REQUIREMENTS**

- A. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required,

as demonstrated by membrane roofing manufacturer based on testing and field experience.

B. Roofing Membrane System Load-Strain Properties: Provide a roofing membrane identical to component systems that have been successfully tested by a qualified independent testing and inspecting agency to meet the following minimum load-strain properties at membrane failure when tested according to ASTM D2523:

1. Tensile strain at failure, at 0 deg F (-18 deg C): 600 lbf(2.67 kN) cross machine direction, minimum; 4.0 to 5.5 percent elongation at break.

#### 1.5 QUALITY CONTROL:

A. Installer Qualifications:

1. Licensed or approved in writing by manufacturer to perform work under warranty requirements of this Section.
2. Employ full-time supervisors knowledgeable and experienced in roofing of similar types and scopes, and able to communicate with owner and workers.

B. Product/Material Requirements:

1. Obtain products from single manufacturer or from sources recommended by manufacturer for use with roofing system and incorporated in manufacturer's warranty.
2. Provide manufacturer's label on each container or certification with each load of bulk bitumen, indicating Flash Point (FP), Finished Blowing Temperature (FBT), Softening Point (SP), Equiviscous Temperature (EVT).
3. Provide manufacturer's certification that field applied bituminous coatings and mastics, and field applied roof coatings comply with limits for Volatile Organic Compounds (VOC) per the National Volatile Organic Compound Emission Standards for Architectural Coatings pursuant to Section 183(e) of the Clean Air Act with limits as follows:
  - a. Bituminous Coatings and Mastics: 500 g/l (4.2 lb/gal.).

C. Roofing system design standard requirements:

1. Recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to modified bituminous sheet roofing for storage, handling and application.

2. Recommendations of FM Approvals 1-49 Loss Prevention Data Sheet for Perimeter Flashings.
3. Recommendations of ANSI/SPRI ES-1 for roof edge design.
4. FM Approvals Listing: Provide roofing membrane, base flashing, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a roofing system and that are listed in FM Approvals "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
  - a. Fire/Windstorm Classification: Class 1A- 90.
  - b. Hail Resistance: MH.

D. Pre-Roofing Meeting:

1. Upon completion of roof deck installation and prior to any roofing application, hold a pre-roofing meeting arranged by the Contractor and attended by the Roofing Inspector, Material Manufacturers Technical Representative, Roofing Applicator, Contractor, and Resident Engineer.
2. Discuss specific expectations and responsibilities, construction procedures, specification requirements, application, environmental conditions, job and surface readiness, material storage, and protection.
3. Inspect roof deck at this time to:
  - a. Verify that work of other trades which penetrates roof deck is completed.
  - b. Determine adequacy of deck anchorage, presence of foreign material, moisture and unlevel surfaces, or other conditions that would prevent application of roofing system from commencing or cause a roof failure.
  - c. Examine samples and installation instructions of manufacturer.

**1.6 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, SAMPLES.
- B. Product Data:
  1. Asphalt and adhesive materials.
  2. Modified bituminous sheet roofing and flashing membrane.
  3. Roofing cement.
  4. Fastening requirements.

5. Application instructions.

C. Samples:

1. Nails and fasteners, each type.

D. Shop Drawings: Include plans, sections, details, and attachments.

1. Base flashings and terminations.

E. Certificates:

1. Indicating materials and method of application of roofing system meets requirements of FM Approvals "RoofNav" for specified fire/windstorm classification.

2. Indicating compliance with load/strain properties requirement.

F. Warranty: As specified.

G. Documentation of supervisors' and inspectors' qualifications.

H. Field reports of roofing inspector.

I. Contract Close-out Submittals:

1. Maintenance Manuals.

2. Warranty signed by installer and manufacturer.

#### **1.7 DELIVERY, STORAGE AND MARKING:**

A. Comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to built-up roofing for storage, handling and installation.

#### **1.8 ENVIRONMENTAL REQUIREMENTS**

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

B. Environmental Controls: Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

C. Protection of interior spaces: Refer to Section 01 00 00, GENERAL REQUIREMENTS.

#### **1.9 WARRANTY:**

A. Roofing work subject to the terms of the Article "Warranty of Construction", FAR clause 52.246-21, except extend warranty period to [10] years from acceptance of facility by the Government.

**PART 2 - PRODUCTS**

**2.1 ADHESIVE AND ASPHALT MATERIALS:**

- A. General: Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.
  - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Water-Based Asphalt Primer: Water-based, polymer modified, asphalt primer with the following physical properties:
  - 1. Asbestos Content, EPA 600/R13/116: None.
  - 2. Non-Volatile Content, minimum, ASTM D 2823: 30 percent.
  - 3. Volatile Organic Compounds (VOC), maximum, ASTM D 3960: 65 g/L.
- C. Asphalt: ASTM D312, Type III or IV for roof membrane.
- D. Cold-Applied Adhesive for membrane flashing: One-part, cold-applied adhesive specially formulated for compatibility and use with specified roofing membranes and flashings, with the following physical properties:
  - 1. Asbestos Content, EPA 600 R13/116: None.
  - 2. Volatile Organic Compounds (VOC), maximum, ASTM D 6511: <250 g/L.
  - 3. Nonvolatile Content, minimum, ASTM D 6511: 75 percent.
  - 4. Uniformity and Consistency, ASTM D 6511: Pass.
- E. Roof Cement: ASTM D4586, Type II.

**2.2 MEMBRANE AND SHEET MATERIALS:**

- A. Membrane Materials, General: Provide a hot mop applied membrane composed primarily of SBS modified asphalt material fabricated in sheet form and designed for roofing exposed to the weather. Provide minimum two layers between base sheet and cap sheet for "4-ply" installation. Provide additional plies if required by manufacturer to achieve specified warranty. Use sheet materials that have been tested in combination and comply with load/strain properties performance requirement in Part 1 of this Section.
- B. Base Sheet: ASTM D 4601, Type II, nonperforated, asphalt-impregnated and coated glass-fiber sheet dusted with fine mineral surfacing on both sides, with the following properties:
  - 1. Breaking Strength, minimum, ASTM D 146: cross machine direction, 12.2 kN/m (70 lbf/in).
  - 2. Pliability, 12.7 mm (1/2 inch) radius bend, ASTM D 146: No failures.

- C. Membrane Ply Sheet: ASTM D6163, Grade S, Type II or III, glass-fiber-reinforced, SBS -modified asphalt sheet, or ASTM D6162, Grade S, Type II or III, SBS -modified asphalt sheet; smooth surfaced; suitable for application method specified, with the following minimum properties:
  - 1. Tensile Strength at 23 deg. C (73 deg. F), minimum, ASTM D 5147: cross machine direction, 21 kN/m (120 lbf/in).
  - 2. Tear Strength at 23 deg. C (73 deg. F), minimum, ASTM D 5147: cross machine direction 890 N (200 lbf).
  - 3. Elongation at 23 deg. C (73 deg. F), minimum, at 5 percent maximum load ASTM D 5147: cross machine direction, 40 percent.
- D. Membrane Cap Sheet: ASTM D6163, Grade G, Type II, glass-fiber-reinforced, SBS modified asphalt sheet; granular surfaced; and as follows:
  - 1. Exterior Fire-Test Exposure, ASTM E108: Class A.
  - 2. Tensile Strength at 23 deg. C (73 deg. F), minimum, cross machine direction, ASTM D5147: 24 kN/m (140 lbf/in).
  - 3. Tear Strength at 23 deg. C (73 deg. F), minimum, cross machine direction, ASTM D5147: 880 N (200 lbf).
  - 4. Elongation at 23 deg. C (73 deg. F), minimum, cross machine direction, at 5 percent maximum load ASTM D5147: 40 percent.
  - 5. Low Temperature Flex, maximum, ASTM D5147: -31 deg. C (-25 deg. F).
- E. Base Flashing Backer Sheet: ASTM D4601, Type II, asphalt-impregnated and coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.
- F. Base Flashing Sheet: ASTM D6164, Grade G, Type II, polyester-reinforced, SBS-modified asphalt sheet; granular surfaced; Granule Color: White.

### 2.3 FASTENERS:

- A. Roofing Fasteners: Factory-coated steel fasteners and metal or plastic plates, where applicable, meeting requirements of FM Approvals 4470, tested by fastener manufacturer for required pullout strength, and recommended by roofing manufacturer for application.
- B. Accessory Fasteners: Corrosion-resistant fasteners compatible with adjacent materials and recommended for application by manufacturer of component to be fastened.

**PART 3 - EXECUTION**

**3.1 EXAMINATION:**

- A. Examine substrates and conditions with roofing Installer and roofing inspector to verify compliance with project requirements and suitability to accept subsequent roofing work. Correct unsatisfactory conditions before proceeding with roofing work.
- B. Do not apply roofing if roof surface will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon unless system is protected.

**3.2 PREPARATION**

- A. Complete roof deck construction prior to commencing roofing work:
  - 1. Install curbs, blocking, edge strips, nailers, cants, and other components where insulation, roofing, and base flashing is attached to, in place ready to receive insulation and roofing.
  - 2. Complete deck and insulation to provide designed drainage to working roof drains.
  - 3. Document installation of related materials to be concealed prior to installing roofing work.
- B. Dry out surfaces, including the flutes of metal deck that become wet from any cause during progress of the work before roofing work is resumed. Apply materials to dry substrates.
- C. Sweep decks to broom clean condition. Remove all dust, dirt or debris.
- D. Remove projections that might damage materials.
- E. Concrete Decks, except Insulating Concrete:
  - 1. Test concrete decks for moisture prior to application of roofing materials. Test for capillary moisture by plastic sheet method according to ASTM D4263.
  - 2. Test concrete decks for moisture by pouring one pint of hot bitumen at 204 degrees C (400 degrees F.) or EVT on deck at start of each day's Work and at start of each new roof area or plane. Do not proceed if test sample foams or can be easily (cleanly) stripped after cooling.
  - 3. Prime concrete decks, including precast units, with primer as specified. Keep primer back four inches from joints in precast units.
  - 4. Allow primer to dry before application of bitumen.

### **3.3 HEATING BITUMEN**

- A. Heat the asphalt to the equiviscous temperature plus or minus -4 deg. C (25 deg. F) at the time of application:
  - 1. Do not heat asphalt greater than 38 deg. C (100 deg. F) above the equiviscous temperature.
  - 2. When the equiviscous temperature is not furnished by the asphalt manufacturer, do not heat asphalt above 275 deg. C (525 deg. F) for Type III and IV with temperature not less than 250 deg. C (475 deg. F) at time of application.
- B. Do not heat bitumen above the flash point temperature.
- C. Provide heating kettles with a thermometer kept in operating condition. Attend kettle during heating to insure that the bitumens are heated within the temperatures specified.
- D. Use type III and Type IV asphalt between plies.
- E. Do not mix different type of asphalt in kettle.

### **3.4 TEMPORARY PROTECTION**

- A. Install temporary protection at the end of day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent. Comply with approved temporary protection plan.
- B. Install temporary cap flashing over the top of base flashings where permanent flashings are not in place to provide protection against moisture entering the roof system through or behind the base flashing. Securely anchor in place to prevent blow off and damage by construction activities.
  - 1. Glaze coat exposed surfaces of felts to seal within the bitumen coating. Do not leave felt surfaces or edges exposed.
- C. Provide for removal of water or drainage of water away from the work.
- D. Provide temporary protection over installed roofing by means of duckboard walkways, plywood platforms, or other materials, as approved by Resident Engineer, for roof areas that are to remain intact, and that are subject to foot traffic and damage. Provide notches in sleepers to permit free drainage.

### **3.5 INSTALLATION, GENERAL**

- A. FM Approvals Installation Standard: Install roofing membrane, base flashings, wood cants, blocking, curbs, and nailers, and component materials in compliance with requirements in FMG 4450 and FMG 4470 as

part of a membrane roofing system as listed in FM Approval's "RoofNav" for fire/windstorm classification indicated. Comply with recommendations in FM Approvals' Loss Prevention Data Sheet 1-49, including requirements for wood nailers and cants.

- B. NRCA Installation Standard: Install roofing system in accordance with applicable NRCA Manual Plates and NRCA recommendations, including ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing"
- C. Manufacturer Recommendations: Comply with roofing system manufacturer's written installation recommendations.
- D. Coordination with related work: Coordinate roof operations with roof insulation and sheet metal work so that insulation and flashings are installed concurrently to permit continuous roofing operations.
- E. Installation Conditions:
  - 1. Apply dry roofing materials. Apply roofing work over dry substrates and materials.
  - 2. Apply materials within temperature range and surface and ambient conditions recommended by manufacturer.
  - 3. Except for temporary protection, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, snow, ice, fog or frost) is present in any amount in or on the materials to be covered or installed:
    - a. Do not apply materials when the temperature is below 4 deg. C (40 deg. F).
    - b. Do not apply materials to substrate having temperature of 4 deg. C (40 deg. F) or less.

### **3.6 INSTALLATION OF MODIFIED BITUMEN MEMBRANE:**

- A. Primer: Apply primer to substrates where recommended by roofing manufacturer, in application quantities recommended by roofing manufacturer.
- B. Hot Roofing Asphalt: Apply hot roofing asphalt in quantities required, immediately followed by membrane materials embedded therein before bitumen cools below the application temperature limit.
  - 1. Do not apply more material than can be covered at one time except for glaze coats.
  - 2. Recoat cooled areas.

3. Application rate between substrate and sheets: 7 to 11 Kg (15 to 25 pounds) per square.

4. Application rate for glaze coats: 7 to 11 Kg (15 to 25 pounds).

C. Membrane Sheets:

1. Number of Plies: 2, minimum, including base sheet and cap sheet, and additional plies as required to meet load/strain properties specified in Part 1 of this Section.

2. Commence the laying of sheets at the low points.

3. Roll sheets into hot roofing asphalt brushing down to firmly embed, free of wrinkles, fish mouths, blisters, bubbles, voids, air pockets or other defects that prevent complete adhesion:

4. Cut to fit closely around pipes, roof drains, bitumen stops, and similar roof projections.

5. Lap sheets shingle fashion starting with starter strips at right angles to slope of roof.

6. Laps for Top Sheet and Base Sheet:

a. Base sheet, lapped 75 mm (three inches).

b. Use 450 mm (18 inch) starting widths, lap top sheet 475 mm (19 inches).

c. Lap end joints of sheet 150 mm (six inches). Stagger end joints in relation to end joints in adjacent and proceeding plies.

D. Roofing on Nailable Decks:

1. On insulating concrete, install one ply of venting base sheet with mineral aggregate surface down, nailed to deck with lap as specified and seal lap edges with roof cement. Terminate venting base sheet as follows:

a. At vertical surfaces: Extend venting base sheet up vertical surface over cants to top of base flashing or curb.

b. At roof edge under gravel stops install venting base sheet over blocking: Extend base sheet not less than two inches beyond outer edge and turn down so that venting can be accomplished.

c. At roof edge over fascia-cant: Extend base sheet over top of cant and turn down over outer face of cant to permit venting at the edge.

2. On poured gypsum, precast gypsum plank, cement-wood fiber plank, wood plank, or plywood decks install one layer of building paper followed by base sheet.

- a. Apply building paper lapping ends and edges 50 mm (two inches) Lay smoothly without buckles or wrinkles. Staple or nail sufficiently to hold in place until roof membrane is installed.
  - b. One ply of venting base sheet. Lay base sheet down dry on deck, Nail as specified. Lap as specified and seal lap edges with roof cement.
- E. Roof edges and terminations:
1. Where nailers occur at roof edges under gravel stops or penetrations to receive metal base flashing, apply a continuous strip of underlayment over the nailers before the first ply sheet is applied. Strip shall be installed on top of venting base sheet if any.
  2. After membrane is installed, turn the underlayment back over the roofing, and secure in place with hot roofing asphalt before gravel stops or other metal flanges extending out onto the membrane are installed.
  3. Where cants occur at vertical surfaces, cut off roofing sheets two inches above top of cant strips, except at prefabricated curbs, scuttles and other roof accessories having integral cants, extend membrane over cant and up vertical surface to top of curb or nailer as shown.
  4. Where fascia-cant occurs at roof edges, extend membrane beyond outside cant face and cut off at outside after base flashing is installed.
  5. Where reglet occurs at vertical surfaces, extend plies roofing sheets up into reglet the full depth of the reglet.

### **3.7 BASE FLASHING:**

- A. Provide built-up base flashing over cants and as necessary to make work watertight.
- B. Prime vertical surfaces of masonry and concrete with asphalt primer except where vented base sheet is required to provide edge venting.
- C. Apply flashing on top of roofing, up face of cant and up the face of the vertical surface, at least 200 mm (eight inches) above the roofing but not more than 350 mm (14 inches) above the roofing, generally full height beneath counter flashing or top of curb flashing.
  1. At fascia-cants, extend to top of cant and cut off at top of cant.
  2. At reglet, extend full depth into the reglet.

3. Where venting base sheet is used with insulating concrete, do not seal edges of venting base sheet with bitumen; allow for venting.
- D. Use two plies of modified bituminous sheet.
  1. Extend the first ply 100 mm (four inches) out on the roofing, and the second ply 75 mm (three inches) beyond the first ply. Lap ends 75 mm (three inches) with joints broken 450 mm (18 inches) in each ply. Use smooth surface modified bituminous sheet for first ply.
  2. Use granular surfaced modified bitumen cap sheet.
- E. Set base flashing either in Type III or IV asphalt.
  1. Embed each sheet in asphalt so sheets do not touch.
  2. Set cap sheet in cold-applied adhesive with laps sealed with cold-applied adhesive.
  3. Except for venting roof edges, seal the top edge of the base flashing with roof cement.
- F. Except at metal fascia cants, secure top edge of base flashing with nails on a line approximately 25 mm (one inch) below top edge, spaced not more than 200 mm (eight inches) on center.
  1. Cover nail heads with roof cement.
  2. Cover the top of the base flashing with counterflashing as specified in Section 07 60 00, FLASHING AND SHEET METAL. At the fascia cants secure the top edge of the flashing with fascia compression clamp as specified in Section 07 60 00, FLASHING AND SHEET METAL.

### **3.8 STRIPPING:**

- A. Coordinate to set flanges of metal flashing in roof cement on top sheet of the modified bituminous roofing and mailing to blocking with Section 07 60 00, FLASHING AND SHEET METAL.

### **3.9 APPLICATION OF COATING**

- A. Apply coating to membrane and base flashings according to manufacturer's written instructions by spray or roller.
- B. Provide dry film thickness of minimum 20 mils (0.5 mm).

### **3.10 FIELD QUALITY CONTROL:**

- A. Roofing Inspector: Contractor shall engage a qualified roofing inspector for a minimum of 5 full-time days on site to perform roof tests and inspections and to prepare start up, interim, and final reports. Roofing Inspector's quality assurance inspections shall comply

with criteria established in ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing."

- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
  - 1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
- C. Repair or remove and replace components of roofing work where test results or inspections indicate that they do not comply with specified requirements.
  - 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

### **3.11 PROTECTING AND CLEANING**

- A. Protect membrane roofing system from damage and wear during remainder of construction period.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of acceptance by Owner.
- C. Clean overspray and spillage from adjacent construction. Clean membrane and restore surface to like-new condition meeting solar reflectance requirements.

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